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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL VEHICLE AND FUEL EMISSIONS LABORATORY
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OFFICE OF
AIR AND RADIATION

MEMORANDUM

Subject: Snowmobile Emissions Test Results

To: Linc Wehrly, Assessment and Modeling Division

From: James Warila, Environmental Scientist
Assessment & Modeling Division

Date: November 13, 2000

Attached is a summary of the snowmobile emissions test results compiled for use in the Recreational Equipment Finding and the sources from which they were derived. The values represent cycle-weighted averages. The cycle identified as "ISMA 5-mode" is the cycle recently developed for use snowmobile engine testing. The cycle and its development are described in White et al. (1995), Buckingham et al. (1996), and Wright and White (1997).

Attachments

Snowmobile Emission Factors

Source	#engines	disp (cc)	hp	str	cyl	cycle	Emission Factors (g/hp-hr) THC	CO	NOx	PM	BSFC (lb/hp-hr)
Carroll 1999 (SwRI) YNP	1	480	50	2	2	"ISMA 5 mode"	115	375	0.69	0.7	
White et al. 1997 (White & Carroll 1998)	1	488		2	2	"ISMA 5 mode"	150	420	0.42	1.1	1.1
White et al. 1997 (White & Carroll 1998)	1	440		2	2	"ISMA 5 mode"	160	370	0.50	3.4	1.1
Hare & Springer 1974	1	436	32	2			89	142	1.40	6.1	0.9
Hare & Springer 1974	1	335	25	2			120	235	1.80	2.5	1.1
Hare & Springer 1974	1	247	16	2			200	63	3.40	2.6	1.2
Wright & White 1998	1	440		2		"ISMA 5 mode"	130	380	0.42		
Wright & White 1998	1	503				"ISMA 5 mode"	105	400	0.73		
ISMA #1	1	600	68		2	"ISMA 5 mode"	110	218	0.86		0.8
ISMA #2	1	440	34		2	"ISMA 5 mode"	95	312	1.62		0.9
ISMA #3	1	600	93		3	"ISMA 5 mode"	106	196	1.30		0.8
ISMA #4	1	900	120		3	"ISMA 5 mode"	95	215	0.84		0.8
ISMA #5	1	698	56		3	"ISMA 5 mode"	92	298	0.34		2.4
ISMA #6	1	597	51		2	"ISMA 5 mode"	100	328	0.30		2.8
ISMA #7	1	695	25		3	"ISMA 5 mode"	88	345	0.24		2.1
ISMA #8	1	485	27		2	"ISMA 5 mode"	148	385	0.56		3.2
ISMA #9	1	340	19		2	"ISMA 5 mode"	104	297	0.84		3.2
ISMA #10	1	440	43		2	"ISMA 5 mode"	95	294	0.56		1.1
ISMA #11	1	600	56		2	"ISMA 5 mode"	94	262	0.81		1.8
ISMA #12	1	700	59		2	"ISMA 5 mode"	102	355	0.69		3.1
ISMA #13	1	593				"ISMA 5 mode"	67	288	0.57		
ISMA #14	1	494				"ISMA 5 mode"	105	400	0.43		
ISMA #15	1	699				"ISMA 5 mode"	92	276	0.50		
Mean							***111***	***298***	***0.86***		***1.66***

Carroll JN. 1999. Characterization of Snowmobile Particulate Emissions. Final Letter Report, SwRI Project 08-2457. Memorandum to Kezha Hatier-Riess, Program Director, Yellowstone Park Foundation, dated 5 August 1999.

used summary results from Table 5, weighted BASE total.

Hare CT, Springer KJ, Huls TA. 1974. Snowmobile Engine Emissions and Their Impact. SAE 740735

used summary values from Table 7, exluding Arctic 440 (Rich) and Rotary

White JJ, Carroll JN, Haines HE. 1997. Emissions from Snowmobile Engines Using Bio-based Fuels and Lubricants. SAE 972108.

used summary values from Tables 6 and 7, baseline gasoline (mean), and converted units

White JJ, Carroll JN. 1998. Emissions from Snowmobile Engines Using Bio-based Fuels and Lubricants. Southwest Research Institute, San Antonio, TX. SwRI 08-7383. Prepared for Montana Department of Environmental Quality, Helena.

Buckingham JP, White JJ, Carroll JN. 1996. Development of Snowmobile Test Cycle. Southwest Research Institute, San Antonio, TX. SwRI-7574. Prepared for International Snowmobile Manufacturers Association.

White JJ, Smith MJ, Carroll JN. 1995. Determination of Snowmobile Operating Cycles. Southwest Research Institute, San Antonio, TX. SwRI-6894. Prepared for International Snowmobile Manufacturers Association.

Wright CW, White JJ. 1997. Development and Validation of a Snowmobile Engine Test Procedure. SAE Tech Paper 982017.

used mean values from tables 7 and 8 and converted units

ISMA #1-15. Results of manufacturers tests, provided to US EPA by Ed Klim, International SnowMobile Manufacturers Association, 16 March 2000

results represent machines produced by 4 manufacturers.